

AUTOMATIZED SYSTEM OF THE PROCESSING AND ANALYSIS  
OF THE EARTHQUAKE RECORDS AT THE ENGINEERING-  
SEISMOMETRIC SERVICE STATIONS.

Denisov B.E. \*, Zhukov E.E. \*\*, Mamaeva G.V. \*\*,  
Kakhnovsky A.M. \*\*\*, Levin A.I. \*\*\*

The response of buildings and structures on the seismic effects is registered at the engineering-seismometric service stations of the U.S.S.R. Processing and analysis of the records are performed in the information-amassment centre by the automatized complex on the basis of electronic computer M-220. The perfocards of the earthquake records are also used in high-capacity computers to analyse the response of the complex systems on effects represented by real ground motions.

The research program carried out at the engineering-seismometric stations is stipulated with due account of specific features of the structure and involves studies of two basic problems: interaction of load-bearing structures of the building with its foundation and distribution of seismic forces between the members of spatial load-bearing structures. The standard engineering-seismometric station permits to register the oscillations in three-four points under observation from which one is located on the ground at the distance of 20-30 meter from the building and the rest, as a rule, are installed on the load-bearing structures at one vertical. On the objects of high composition and extended in plan the points of the instrumental observation are set according to spatial scheme which permits to obtain information about non-synphase motions of the individual parts of a buildings, torsional oscillations deformations of the members of the load-bearing structures.

The seismic detectors of S5S, VBP-3, SPM-16, VEGIK types installed on the buildings and on the ground record during the earthquake acceleration, speed, displacement in three directions and at two-three levels from 3 to 6 intensity of the seismic scale. The total great number of recording canals permits to obtain extensive information at the engineering-seismometric stations. At the same time the joint processing of the oscillograms ensembles offers con-

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\* Cand. Eng., Head of Engineering-Seismometric Service Laboratory, the Central Research Institute for Building Structures, Moscow, U.S.S.R.

\*\* Cand. Eng., Senior Research Workers of Engineering-Seismometric Service Laboratory, the same Institute, Moscow, U.S.S.R.

\*\*\* Engineers, the same Laboratory.

siderable difficulties. In this connection the oscillograms are processing in some steps. At the earliest possible date after an earthquake the initial report is made; in this report total data about the earthquake and the state of load-bearing structures of the object under observation are brought and the greatest amplitudes of oscillations and the appropriate periods are indicated.

More detailed processing of individual oscillograms involves the following steps: the maximum amplitudes and appropriate obvious periods of the ground oscillations and the load-bearing structures are determined, these values are compared with various points of buildings; the intensity of the earthquake is defined after readings of seismoscops. The records expanded in time are transformed into digital form for the subsequent analysis on computer. The amplitude-frequency spectra and the response spectra of single-mass systems according to records of ground oscillations and individual points of a building are calculated.

The statistical processing of oscillograms is carried out according to total rules of the random processes analysis. The analysis of oscillograms ensembles obtained at the engineering-seismometric stations is carried out in accordance with the research program and has for an object to bring to light specific features of space deformation of the load-bearing structures during the earthquakes. Depending on specific features of the object under investigation at the individual stations the special schemes of location of the measuring apparatus for registration, for example, of torsional oscillations, mutual displacements of floors by oscillations etc. are employed.

At all steps of the oscillograms processing it is important opportunely to bring to light and to eliminate possible errors of measurements. At the stations of the engineering-seismometric service the apparatus with galvanometrical direct optical and mechanical records is used. By the processing of records the main parameters of recording apparatus are taken into account, the sensitivity of canals with the galvanometrical registration determining experimentally at the calibrated platforms or by design method and the sensitivity of the accelerographs of the strong ground motion and seismoscopes is defined at the plant and is indicated in the certificate of a device. The process of oscillograms digitizing causes undiserable changes into initial information under investigation. In TsNIISK a number of the experiments discovering the errors brought by the digital process of oscillograms is carried out. The experiment was fulfilled on the semiautomatic complex sufficiently simple by construction and reliable by operation, this complex allows to process the oscillograms undepending on the number of the pathes and their interaction. As a result of the experiment the errors are classified, their reasons and the possible ways of their elimination are determined. The expected

errors increase considerable in the long-term part of the spectrum.

At present the semiautomatic and automatic reading devices are spread approximately equally. The automatic devices make sufficiently high demands of the quality of the diagrams under processing - the paths of the records must not be intersected; the minimum contrasting, the minimum thickness of a line of the record, the distance between the paths are regulated. The semi-automatic devices don't require special preparation of the oscillograms.

The engineering-seismometrical service on buildings gives more and more extensive information about the response of the load-bearing structures on the earthquakes. Only in Petropavlovsk-Kamchatskij during the past 3 years over 200 records of the earthquakes were obtained among which two earthquakes were of the intensity over 7.

On developing of the engineering-seismometric service on the buildings more high demands are made of the selection of objects under observation, of schemes of location of the recording instruments, the quality and the amount of processing information. An effectual means of the information increasing of the engineering-seismometric service is the practical application of the methods of planning theory of an engineering experiment. The arrangements of this direction are carried out in TsNIISK on basis of the existing and recently organized stations of the engineering-seismometric service.

- a) "Automatized System of the Processing and Analysis of the Earthquake Records at the Engineering-Seismometric Service Stations".
- b) Denisov B.E., Zhukov E.E., Mamaeva G.V., Kakhnovsky A.M. and Levin A.I.
- c) Earthquake Instrumentation.
- d) Denisov B.E., Cand.Eng., Head of Engineering-Seismometric Service Laboratory, Central Research Institute for Building Structures, Gosstroy, USSR  
Zhukov E.E., Cand.Eng., Senior Research Worker of Engineering-Seismometric Service Laboratory, the same Institute,  
Mamaeva G.V., Cand.Eng., Senior Research Worker of Engineering-Seismometric Service Laboratory, the same Institute  
Kakhnovsky A.M., Engineer of Engineering-Seismometric Service Laboratory, the same Institute  
Levin A.I., Engineer of Engineering-Seismometric Service Laboratory, the same Institute.

Address: Gosstroy of the USSR, Prospect Marx, 12  
Moscow K-9, U.S.S.R.